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(54) Food casings and method of making same

(57) In food casings e.g. as used in the processed meat industry for various types of sausages, hams, beef roles etc, the surface appearance is important and many products require the use of "smoking" to impart a characteristic brown colour. A non-toxic safe and stable smoke coloring agent comprises a reaction product of a reducing sugar and an amino acid or amino acid derivative, coated onto the casing and dried. The reaction mixture may also contain a citrate.

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SPECIFICATION

Food casings and method of making same

This invention relates to methods of treating a food casing with reagents to impart a water soluble smoke color to the casing and also relates to the resultant improved treated casing, that can impart smoke color to food products processed therein. In particular this invention relates to a method of coating a fibrous or non-fibrous regenerated cellulose tubular food casing with an aqueous solution of an amino acid and a reducing sugar hereinafter, referred to as unreacted Maillard reagents, which react in situ in the casing to produce a water soluble brown smoke color in the casing, that ultimately transfers from the casing to the surface of a subsequently encased meat product, giving the meat product a rich brown smoke color.

An alternate embodiment of the invention is to coat the casing directly with a Maillard reaction product of an amino acid and a reducing sugar, eliminating the need for in situ reaction.

This invention also relates to collagen casing treated by the methods of this invention.

Tubular food casings are used extensively for processing a great variety of meat products and other food items. The food casings are generally thin-walled tubing of various diameters prepared by methods well known in the art from reconstituted materials, and particularly cellulose derivatives such as regenerated cellulose. Cellulose food casings may also be prepared with fibrous webs embedded in the wall thereof, such casings commonly being referred to as "fibrous food casings." Edible food casings may be prepared from ollagen and are known as "collagen casing." Typical processes for the production of collagen casing are disclosed in U.S. Patents 3,551,535 issued December 29, 1970 and 3,782,977 issued January 1, 1974 each to W. E. Henderson et al and U.S. Patent 3,956,512 issued May 11, 1976 to T. E. Higgins.

The many different recipes and modes of processing that are used by the processed food industry to suit different tastes and even regional preferences generally necessitates the use of food casings with a variety of characteristics. In some instances, for example, food casings are required to have multifunctional uses wherein they serve as containers during the processing of a food product encased therein and then also serve as a protective wrapping for the finished product. In the processed meat industry, however, the food casings, especially those derived from cellulose, used in the preparation of many types of meat products, such as various types of sausages, beef rolls, hams and the like, are frequently removed from about the processed meat product prior to slicing and/or final packaging.

Surface appearance is an important factor in the commercial and consumer acceptance of most processed meat products and a common feature of most varieties of such products involves the use of "smoking" for imparting a characteristic brown color thereto. In the past, the smoking of food products was generally accomplished by the food processors subjecting the food product to actual contact with smoke in a gaseous or cloud-like form. Such smoking processes, however, have been considered unsatisfactory for a variety of reasons including the inefficiencies and lack of uniformity of the smoking operation. Because of the shortcomings experienced, the trend has been to employ various types of liquid aqueous solutions of smoke colors commonly called "liquid smoke solutions" that have been developed and used commercially by the food processor in the processing of many types of meat and other food products.

The application of liquid smoke solutions to meat products is generally carried out in a variety of ways, including spraying or dipping an encased food product during the processing thereof or by incorporating the liquid smoke solution in the recipe itself. The actual operation of smoking by spraying or dipping is not completely satisfactory due to the equipment expenses and the limited degree of control that has been found, and incorporation of liquid smoke solutions in the meat recipe does not always provide the desired surface appearance because of dilution of smoke ingredients.

It has also been suggested, as for example disclosed in U.S. Patent No. 3,330,669 to Hollenbeck, that application of a viscous liquid smoke solution to the inside surface of a tubular food casing by the food processor immediately prior to the stuffing thereof with a sausage emulsion results in preparation of processed food products that exhibit good color after cooking and removal of the casing.

Heretofore, however, it has been found that providing casings to afford special treatment or structural characteristics to the food product can be more uniformly and economically accomplished by the casing manufacturer. This is especially true with the advant and wide commercial use of automatic stuffing and processing equipment in the processed food industry.

Several methods of providing food casings with coatings applied to a surface thereof are known and described in the patent literature. There is disclosed, for example, in U.S. Patent No. 3,451,827 a spraying method for applying a variety of coating materials over the internal surface of small diameter casings and in U.S. Patent No. 3,378,379 to Shiner et al, a "slugging" method used for applying coating materials to the internal surface of large diameter casings. While such techniques and others have been used in preparing commercial quantities of coated food casings, the casings prepared thereby are, in general, used to meet particular commercial requirements and to the best of our knowledge none of the coated casings disclosed in the art are completely satisfactory for or are intended to specifically impart smoke color to a meat product processed therein. In U.S. Patent Nos. 3,360,383 to Rose et al, and 3,383,223 and 3,617,312 to Rose, for example, are disclosed coating compositions that employ liquid smoke solutions in amounts that are specifically required to insolubilize a protein material such as gelatin to prepare casings that meet special adhesion properties required for use in the processing or dry sausages, which properties would there-

fore limit the suitability thereof for other casing applications.

Preparation of tubular food casings that could be used in the manufacture of a variety of processed food products and would impart a desired smoke color to the processed product would be highly desirable. Especially advantageous would be food casings that could be prepared using conventional coating methods and that would impart the desired color to products that have the casing removed prior to final packaging or cooking or that are sold with the casing still in place.

Brown dyes, such as chocolate Brown HT, have been considered for casing treatment, but such dye is not considered safe for human consumption. A smoke color dye mixture, such as Stange's smoke color, can be used to give a superficial smoke color to meat products, but, because it is a dye mixture of primary red and blue dyes, which have differing solubility and diffusivity, the surface coloration of the meat products becomes bluish as the red dye diffuses into the meat product with storage. Thus, the unstable Stange's smoke color is not a satisfactory coloring agent.

The deficiencies of the aforementioned smoke coloring agents have been overcome by the present invention, which provides a nontoxic, safe and stable smoke coloring agent consisting of a reaction product of a reducing sugar and an amino acid.

In accordance with the present invention there is provided a tubular food casing that is suitable to impart smoke color to food products encased or processed therein comprising a tubular cellulose food casing having incorporated therein a reaction product of an amino acid and a reducing sugar in amounts specified in more detail hereinafter. It has been discovered that the tubular food casings of the present invention may be used to impart transferable smoke color to a wide variety of meat products processed therein without the need for any further smoking operations by the food processor. Moreover it has been found that said casings may be prepared in the form of shirred casing sticks wherein long continuous lengths of tubular food casing are pleated and compressed into a substantially shortened form thereof, or as short segments of flattened tubing.

Also provided in accordance with the present invention is a smoke colored collagen casing comprising a tubular collagen food casing having incorporated therein a reaction product of an amino acid and a reducing sugar in amounts specified in more detail hereinafter.

Smoke colored collagen casings of this invention are capable of imparting transferable smoke color to food products, such as meat products, encased therein. However, in the practical use of edible collagen casing, once the food product is encased therein, the casing is not removed before human consumption, but consumed with the encased meat product. Therefore, transfer of the smoke color from an edible collagen casing to the encased food product surface is not critical, because in normal use, unlike in the use of peelable cellulose casings, the consumer will not see the food product's actual surface. However, unlike transfer of smoke color from an edible collagen casing, transfer of smoke color from an inedible collagen casing to the encased food product is critical since the inedible casing must be removed before consumption.

Also provided in accordance with the present invention are methods of preparing tubular food casings that are suitable for imparting smoke color to food products encased or processed therein which comprises in one embodiment providing a tubular food casing and applying thereto an aqueous solution of a reducing sugar and an amino acid which are caused to react in situ in the casing according to the well-known Maillard reaction. The Maillard reaction product has a smoke brown color which is water soluble and can transfer to the surface of a meat product which is subsequently stuffed in the treated casing.

The terms "a reaction product" and "Maillard reaction product" as used herein are intended to encompass any and all reaction products which are formed from the Maillard reaction, including any reducing sugar or amino acid in stoichiometric excess, but excluding any water or citrate compounds hereinafter described.

In an alternate embodiment of this invention the Maillard reaction product is coated directly on the casing, obviating the requirement of in situ reaction.

The undesirable browning of foodstuffs, such as orange juice, due to the Maillard reaction between reducing sugars and amino acids is known and is discussed by Wolfrom et al, in "J. Agr. Food Chem.", Vol. 22, No. 5, 1974 at pages 796–800. Also see Greenshields et al, in "Process Biochemistry", December 1972, pp. 11–16. In "The Science of Meat and Meat Products", J. F. Price et al, eds.; 2nd ed.; 1971, at pages 460–461, it is disclosed that reducing sugars cause rapid darkening of bacon on frying, which is ascribed to the Maillard reaction between glucose and amino groups. Neither Wolfrom et al, nor Greenshields et al, nor Price et al disclose the use of the Maillard reaction to color food casing or meat products encased in the treated casings.

The food casings of the present invention may be prepared from tubular casings having varied compositions, such as those well-known in the art as regenerated cellulose casings either with or without fibrous reinforcement. The former is known in the trade as fibrous casing and is reinforced with paper and the like. Other smoke colored casings can be prepared by the methods of this invention, such as those made from cellulose derivatives, collagen (edible and inedible), alginates, amylose, insolubilized polyvinyl alcohol (both fibrous reinforced and unreinforced) and the like.

While the invention particularly relates to tubular food casings, food wrapping materials in other forms such as sheet form may be smoke colored by appropriate modifications of the treating methods of this invention by those skilled in the art.

The casings of this invention can be used to encase meat products including, but not limited to cooked, smoked, dry or semidry sausages such as frankfurters, bolognas, salamis, cervelats, Thuringers, and the like. Cheese products may also be

encased in the casings of this invention.

In a preferred embodiment of this invention involving the use of unreacted Maillard reagents to coat casing, specific details of which are set forth hereinafter, an aqueous solution of at least one amino acid and at least one reducing sugar is first formed. Optionally added to this solution is a citrate compound to increase the reaction rate between the amino acid and reducing sugar. The solution is then coated on tubular gel casing before drying. During drying at elevated temperatures the Maillard reaction occurs between the amino acid and the reducing sugar in situ in the casing, to give the finished casing a smoky brown color. The smoke colored casing can then be stuffed with a food product such as a meat emulsion. The smoky brown color of the casing will transfer to the surface of the encased meat product, so that if the casing is separated from the encased meat after cooking or other further processing well-known in the art, the surface of the meat will have a smoky brown color.

In a preferred embodiment of this invention involving the direct use of a Maillard reaction product to coat casing, specific details of which are set forth hereinafter, an aqueous solution of at least one amino acid and at least one reducing sugar is first formed. Optionally added to this solution is a citrate compound to increase the reaction rate between the amino acid and reducing sugar. The solution is then heated to react the amino acid and the reducing sugar to form a Maillard reaction product and then further heated to evaporate the water content to desired levels and if needed rediluted with water to adjust color concentration before application to the casing. The resultant coating composition is then optionally mixed with antiblock agents and thickeners before the casing is coated. The Maillard reaction product containing composition is then coated on dried tubular food casing giving the casing a smoky brown color. The smoke colored casing can then be stuffed with a food product such as a meat emulsion. The smoky brown color of the casing will transfer to the surface of the encased meat product, so that if the casing is separated from the encased meat after cooking or other further processing well-known in the art, the surface of the meat will have a smoky brown color.

Many amino compounds are suitable for use in this invention. Exemplary of the amino acids which can be employed in the practice of this invention are 4-aminobutyric acid, glycine, alanine, arginine, and the dimers and the trimers thereof, and the like. Also useful are amino acid derivatives such as salts of amino acids like monosodium glutamate and lysine monohydrochloride. The invention is not limited to those amino acids or derivatives specified herein, but may include others selected by those skilled in the art. The amino acids or derivatives may be used individually or as mixtures of various amino acids, or as mixtures of amino acid derivatives or as mixtures of amino acids and amino acid derivatives.

Exemplary of the reducing sugars which can be employed in the practice of this invention are xylose, arabinose, dextrose (d-glucose) and the like. The invention is not limited to those reducing sugars specified herein, but may include others selected by those skilled in the art. The reducing sugars may be used individually or as mixtures of various reducing sugars.

If unreacted Maillard reagents are used to treat casing, then the amount of the treating solution applied to the casing is from about 5 to about 50 milligrams per square inch of casing wall, preferably from about 15 to about 30 mgs/sq. in. Correspondingly, the amount of the reducing sugar applied is from about 0.7 to about 14.0 mg./sq. in. of casing wall, preferably from about 3.7 to about 7.5 mg./sq. in., and the amino acid applied is from about 0.3 to about 7.0 mg./sq. in. of casing wall, preferably from about 1.3 to about 2.7 mg./sq. in.

If a coating composition containing a Maillard reaction product is directly coated on the casing then the amount of the coating compositon applied should be from about 9 to about 35 mgs/sq. in. of casing wall, preferably from about 10 to about 20 mgs/sq. in. depending on whether additional antiblock and/or thickening agents are employed. Correspondingly, the amount of the Maillard reaction product applied is from about 2.7 to about 14 mg./sq. in. of casing wall, preferably from about 3.5 to about 7.0 mg./sq. in.

The casing containing the brown smoke color is subsequently stuffed with a meat product. The smoke color transfers to the surface of the encased meat product.

The final smoke colored casing produced by the methods of this invention should contain a Maillard reaction product of an amino acid and a reducing sugar at a level from about 2.7 to about 14 milligrams of reaction product per square inch of casing wall, preferably about 3.5 to about 7.0 mg. per sq. in., in order to impart the smoke color to a food product encased therein.

The preferred level of Maillard reaction product in the casing which ultimately is transferred to the surface of the encased meat product is dependent upon individual color preferences of the consumers. Some would prefer a dark brown sausage while others a light brown sausage.

The method of applying the treating agents to the casing can be selected from various known techniques such as slugging, which is also known as bubble coating (U.S. Patent 3,378,379 to Shiner et al and U.S. Patents 3,360,383 to Rose et al; U.S. 3,383,223 to Rose; and U.S. 3,427,169 to Rose et al), dipping (U.S. Patent 3,378,379), spraying (U.S. Patent 3,330,669 to Hollenbeck) or internally coating the casing while shirring by the method disclosed by Bridgeford in U.S. Reissue 28,281.

The slugging method for coating the inside of a casing involves filling a portion of the casing with the coating material, so that the slug of coating material generally resides at the bottom of a "U" shape formed by the casing draped over two parallel rollers, and then moving the continuous indefinite length of casing so that the slug of coating material remains confined within the casing, while the casing moves past the slug and is coated on its inside wall by the coating material contained within the slug.

The dipping method for coating a casing involves

in its simplest form immersing the casing in a bath of treating solution for a sufficient period of time to coat the outside of the casing or in a continuous process passing an indefinite length of casing over guide rolls through a treatment bath.

The spraying method may be used to coat the outside of the casing or the inside surface of the casing by the use of nozzles such as disclosed by Hollenbeck.

Depending upon which embodiment of this invention is chosen, the tubular casing can be either coated on its outside surface or on its inside surface with the treating solution of the unreacted amino acids and reducing sugars or the composition already containing a Maillard reaction product. The coating on the casing wall penetrates throughout the casing to yield a uniform radial distribution of the coating's components in the casing. Preferably, the casing is coated on its inner surface, to maximize contact of the Maillard reaction product with the subsequently encased meat products. If the casing is coated on its outside wall, the coating will penetrate to the inside wall, so that subsequent transfer of the Maillard reaction product coloring agent to an encased meat product will take place. However, the surface of the casing on which the treating agents of this invention was initially coated will have a slightly higher concentration of the Maillard coloring agent than the opposite surface which did not receive the coating. Of course, the casing may be coated on its outer wall and then turned inside-out for stuffing, if so desired. Because the casings utilized in the practice of this invention are thin walled generally of a thickness of about 1 mils to about 10 mils, the differential coloring agent concentration between the inner and outer casing surfaces has no significant effect on the color of the casing or the color transferred to the encased meat product.

Coating compositions of unreacted Maillard reagents suitable for use in accordance with the embodiments of the present invention are preferably homogeneous aqueous solutions of the amino acids and reducing sugars.

The molar ratio of the reducing sugar to the amino acid in the unreacted Maillard reagents aqueous treating solution used to coat food casings within the practice of this invention should be from about, 10 to 1, to about, 1 to 10, preferably about, 1 to 1, to about, 1 to 5.

In the preparation of the unreacted Maillard reagents treating solution the amount of water used should be that minimum amount which is just sufficient to dissolve all the components of the solution, that is from about 40 to about 70 weight percent water based upon the total weight of the final solution, preferably from about 40 to about 50 weight percent water.

In the alternate embodiment of this invention, the composition used to directly coat casings with a Maillard reaction product is prepared by first preparing an aqueous solution of an amino acid and a reducing sugar in the same proportions of amino acid, reducing sugar and water as outlined above for the embodiment of this invention directed to unreacted Maillard reagents, and then heating the solution to a temperature in the range of from about 60°C to about 110°C for about 5 minutes to about 30 minutes to cause the Maillard reaction to take place, preferably from about 90°C to about 100°C for about 10 to about 20 minutes, and then additionally heating for a sufficient amount of time to evaporate the water to from about 5 to about 10 weight percent water. The Maillard reaction product containing composition is then re-diluted with water, before coating the casing, to a water content of about 25 to about 50 weight percent, preferably about 30 to about 35 weight percent. Casing can also be coated with an unevaporated Maillard reaction product containing composition, if a lighter color is desired. Color concentration is readily controlled by those skilled in the art by proper evaporation and/or redilution.

Potassium citrate may be added as potassium citrate hydrate to the aqueous solution of an amino acid and a reducing sugar in order to increase the rate of the color development in the casing by the in situ Maillard reaction. If potassium citrate is used, the molar ratio of potassium citrate to reducing sugar in the aqueous treating solution used to coat the casings should be from about, 1 to 20, to about, 1 to 1, preferably about, 3 to 4. Sodium citrate as sodium citrate hydrate may be added instead of potassium citrate in the same molar ratios with the same effect.

With respect to the preparation of the coating composition already containing a Maillard reaction product, the Maillard reaction rate is not as important as in the case of casing treatment with an unreacted solution of a reducing sugar and an amino acid where the casing has to be heated to develop the color in situ, and preferably dried at the same time. Thus, in the embodiment of this invention involving casing treatment with unreacted Maillard reagents the rate of color development has to be co-ordinated with casing drying, while in the embodiment of this invention involving the direct use of a Maillard reaction product to coat the casing, color development is not generally co-ordinated with casing drying. In fact the Maillard reaction product is preferably coated on previously dried casing. Therefore, since color development rate control is not critical in the preparation of the coating composition containing the Maillard reaction product, the use of potassium or sodium citrate is optional and the concentration used is generally less than that used in the preparation of the unreacted Maillard treating solution. If used, the amount of potassium or sodium citrate added in hydrate form to prepare the coating composition containing the Maillard reaction product, is expressed as a molar ratio of the potassium or sodium citrate to reducing sugar used and is on the order of from about 0 to 1, to about, 1 to 1, preferably about 3 to 4.

Optionally, prior to the coating step, thickeners and antiblock agents are added to the coating composition containing the Maillard reaction product which also contains about 25 to about 50 weight percent water. The thickeners are added to increase the viscosity of the mixture in order to obtain a thicker coating on the casing, if it is desired to supply

increased color to the casing. Thickeners which can be employed include, but are not limited to aqueous cellulose gum solutions such as solutions of carboxymethyl- cellulose, methyl- cellulose, and the like and aqueous solutions of pectin, vegetable gum or starch and the like. Antiblock agents are added to prevent the treated casing from sticking to itself. Any compatible antiblock agent can be employed such as a water emulsion of food grade mineral oil, vegatable oil, silicone oil, and the like. If a mineral oil emulsion is employed, the final coating composition containing the Maillard reaction product is an emulsion with the Maillard reaction product dissolved in the water phase. In the practice of this invention the difference between a solution and an emulsion is not critical. The amount of antiblock and thickening agents employed in the coating composition is dependent upon the type of agents. Preferably about 5 to about 15 weight percent antiblock agent and about 0.5 to about 2 weight percent thickeners are used. If dry casing is coated with such a mixture containing the additional antiblock and thickening agents, then additional drying after coating will be necessary in order to bring the moisture content of the treated casing back down to a desired level of from about 3 to about 15 weight percent.

Antiblock and thickening agents may also be employed, if desired, with the unreacted Maillard reagents coating solution.

In the well-known conventional methods for preparing regenerated cellulose casing (non-fibrous or fibrous casing) or collagen casing, the final casing processing step is a drying step which encompasses passing the unfinished casing commonly known as gel casing through a hot air dryer wherein the gel casing is dried to a desired moisture content, typically between about 3 weight percent to about 15 weight perceny moisture.

The casing can be coated with an aqueous solution of the unreacted Maillard reagents prior to the drying of the gel casing or after the drying step. Preferably, the casing is coated immediately prior to the drying step so that the elevated temperature of the drying step can serve to both dry the gel casing and cause the Maillard reaction between the amino acid and the reducing sugar of the coating to occur in situ in the casing, producing reaction products which give the casing a rich smoky brown color which is readily transferable from the casing to the surface of a meat product which is subsequently stuffed in the casing. The drying temperature and time are interdependent and should range from about 80°C for about 24 hours to about 120°C for about 5 minutes, and preferably from about 100°C to about 110°C for about 10 to about 15 minutes.

If the casing is coated after the drying step, then an additional heating step is required at from about 30°C to about 120°C for about 1 minute to about 30 days to cause the Maillard reaction to take place, and preferably from about 70°C to about 90°C for about 15 minutes to about 10 hours.

The drying time and temperature are interdependent factors insofar as affecting the drying of the casing to desired moisture levels as well as affecting the Maillard reaction. If the casing is coated after drying requiring an additional heating step, the interdependent heating time and temperature should be selected by those skilled in the art to be sufficient to achieve in situ Maillard reaction in the casing while maintaining desired final moisture levels in the casing and minimizing the necessity of re-moisturizing the casing.

If it is desired to coat casing with a coating composition already containing a Maillard reaction product, this also can be performed before or after the casing drying step. Because the Maillard reagents in this instance are pre-reacted, the heat from the drying step is not needed to cause the reaction to take place in situ in the casing, and therefore, the casing is preferably coated after the drying step. Even if coated after drying, some additional drying may be necessary depending on the water content of the coating composition containing the Maillard reaction product. This additional drying can be performed at from about 80°C for about 10 minutes to about 120°C for about 1 minute, and preferably from about 90°C to about 100°C for about 2 to about 5 minutes.

Coating compositions of unreacted Maillard reagents or those containing a Maillard reaction product can also be used in conjunction with liquid smoke which is well known in the art as a smoke coloring and flavoring agent for meat products.

Suitable coating compositions may also contain those ingredients that are known in the art as useful for imparting a variety of desirable characteristics to food casings, such as improved shirrability, peelability, pliability and the like.

The following examples are set forth as being merely illustrative of the invention and are not intended, in any manner, to be limitative thereof. Unless otherwise indicated, all parts and percentages are by weight.

EXAMPLE I

This example illustrates the treatment of fibrous casing with unreacted Maillard reagents which react in situ in the casing to give transferable smoke color.

200 grams of glycine, 400 grams of xylose and 300 grams of potassium citrate hydrate are dissolved in 800 grams of water at room temperature, 23°C.

The solution is coated on the inside wall of tubular fibrous gel casing having a composition of cellulose 25 weight percent, at room temperature by the sluggish method. The solution is uniformly applied to the casing at a level of 25 milligrams of solution per square inch of casing wall. The coating solution penetrates throughout the casing wall. The casing is then hot air dried at 105°C for 15 minutes. The dried casing has a uniform smoky brown color. The finished casing has a composition, excluding the solids of the treating solution of this invention, of cellulose 71.2 weight percent, water 6 weight percent and glycerine 22.8 weight percent. The finished smoke colored casing has an amount of the Maillard reaction products of the amino acid glycine and the reducing sugar xylose of 9.0 milligrams per square inch of casing wall.

EXAMPLE II

This example illustrates the transferability of the smoke color from a food casing, treated with Maillard reagents reacted in situ, to an encased proces-

sed meat product.

The smoke colored fibrous casing prepared as in Example I, is stuffed wit bologna emulsion. The bologna is further processed by steps well-known in the art, but without a conventional smoking step. The casing is then peeled from the finished bologna revealing a bologna with a smoke brown colored surface. A control sample stuffed in an untreated casing and processed under similar conditions does not have the smoke color.

EXAMPLE III

This example illustrates the treatmen of non-fibrous cellulose casing with a coating composition already containing a Maillard reaction product which gives the casing a transferable brown smoke color.

100 grams of monosodium glutamate, 200 grams of dextrose and 25 grams of sodium citrate hydrate are dissolved in 750 grams of water and heated at 90°C for 10 minutes to cause the Maillard reaction to take place. The solution is then further heated to evaporate the water, leaving a dark brown paste. Sufficient water is then added to re-dilute the paste so that the composition containing the Maillard reaction product to be coated on the casing has a water content based on total weight of all components of 40 weight percent.

The coating composition is then coated on the inside wall of dried tubular non-fibrous cellulose casing having a composition of cellulose 70.3 weight percent, water 12.1 weight percent and glycerine 17.6 weight percent, at 23°C room temperature by the slugging method. The coating composition is uniformly applied to the casing at a concentration of 20 milligrams of coating composition per square inch of casing wall which is equivalent by excluding citrate and water to 11.0 milligrams of the Maillard reaction product per square inch. The treated casing has a rich smoky brown color.

EXAMPLE IV

This example illustrates the transferability of the smoke color from a food casing, treated with a coating composition already containing a Maillard reaction product, to an encased processed meat product.

The smoke colored non-fibrous cellulose casing prepared as in Example III, is stuffed with frankfurter emulsion.

The frankfurter is processed at 25% relative humidity with a dry bulb temperature maintained at 140°F for 30 minutes. The temperature is then raised from 140° to 180°F over a period of 30 minutes, and then maintained at 180°F until an internal frankfurter product temperature of 160°F is reached. The product is then cold tap-water showered to an internal temperature of 120°F and is held in a 40°F cooler for two hours prior to peeling. The casing is then peeled from the finished frankfurter revealing a frankfurter with a smoke brown colored surface. A control sample stuffed in an untreated casing and processed under similar conditions does not have the smoke color.

EXAMPLE V

This example illustrates the treatment of cellulose casing with a coating composition already containing a Maillard reaction product and which also contains antiblock and thickening agents.

103 grams of 4-aminobutyric acid, 150 grams of xylose, and 50 grams of sodium citrate hydrate are dissolved in 500 grams of water. The solution is heated at 90°C for 5 minutes to cause the Maillard reaction to occur and then further heated to evaporate the water until the water content is 10 weight percent.

To 43 grams of this composition containing a Maillard reaction product are added 15 grams of a 50% food grade mineral oil in water emulsion as an antiblock agent, 28 grams of a 3% aqueous solution of methyl- cellulose as a thickener, and 20 gms of propylene glycol as an inert diluent. The resulting mixture is coated uniformly on dry cellulose casing by the slugging method to give a surface coating of the mixture of 20 mg/sq. in. of casing wall, which is equivalent to 7.0 mg/sq. in. of the Maillard reaction product. The casing is re-dried to a 15 weight percent moisture level and is stuffed with frankfurter emulsion. The stuffed casing is conventionally processed without application of smoke and is then peeled from the frankfurter. The frankfurther has a brown smoke color on its surface, while a control frankfurter similarly processed while encased in an untreated casing does not.

EXAMPLE VI

This example illustrates the treatment of collagen casing with unreacted Maillard reagents which react in situ in the casing to give the casing a smoke color.

An unreacted Maillard reagent solution is prepared as in Example I and applied to a tubular collagen gel casing by spraying and dried as in Example I. The dried casing has a smoky brown color.

EXAMPLE VII

This example illustrates the treatment of collagen casing with a coating composition already containing a Maillard reaction product which gives the casing a smoke color.

A coating composition is prepared as in Example III and applied to a dried tubular collagen casing by spraying so that the Maillard reaction product is coated on the casing at a level as in Example III. The treated casing has a rich smoky brown color.

EXAMPLE VIII

This example illustrates the treatment of cellulose casing with a coating composition containing a Maillard reaction product and liquid smoke.

A dark brown paste is prepared as in Example III. To 4.0 grams of this dark brown paste are added 2.0 grams of a 50% food grade mineral oil in water emulsion as an antiblock agent and 10 grams of liquid smoke. The resulting coating composition is applied to the interior wall of a tubular cellulose casing at a level of about 30 milligrams of coating composition per square inch of casing wall which is equivalent to about 8 mg. of the Maillard reaction product and to about 19 mg. of liquid smoke per sq. in. of casing wall. The treated casing has a smoky brown color and a smoke odor. A frankfurter processed in the treated casing also has a smoky brown color and a smoke odor.

EXAMPLE IX

This example illustrates the treatment of fibrous casing with a coating composition containing a Maillard reaction product and liquid smoke.

A dark brown paste is prepared as in Example III. To 4.0 grams of this dark brown paste are added 2.0 grams of a 50% food grade mineral oil in water emulsion as an antiblock agent and 10 grams of liquid smoke. The resulting coating composition is applied to the interior wall of a tubular fibrous casing at a level of about 30 milligrams of coating composition per square inch of casing wall which is equivalent to about 8 mg. of the Maillard reaction product and to about 19 mg. of liquid smoke per sq. in. of casing wall. The treated casing has a smoky brown color and a smoke odor. A bologna processed in the treated casing also has a smoky brown color and a smoke odor.

CLAIMS

1. A casing suitable for imparting smoke color to food products when encased therein comprising a casing having incorporated therein a reaction product from the reaction of a reducing sugar with an amino compound selected from the group consisting of an amino acid, an amino acid derivative, and a mixture of an amino acid and an amino acid derivative.

2. A casing as claimed in claim 1 wherein the casing is a tubular food casing selected from the group consisting of a cellulose casing, a fibrous cellulose casing, a collagen casing, an insolubilized polyvinyl alcohol casing, and a fibrous insolubilized polyvinyl alcohol casing.

3. A casing as claimed in claim 1 or 2 wherein said amino compound is selected from the group consisting of 4-aminobutyric acid, glycine, lysine monohydro- chloride, alanine, arginine, and monosodium glutamate.

4. A casing as claimed in claim 1, 2 or 3 wherein said reducing sugar is selected from the group consisting of xylose, arabinose and dextrose.

5. A casing as claimed in any one of the preceding claims wherein the casing has liquid smoke additionally incorporated therein.

6. A casing as claimed in any one of the preceding claims which comprises from about 2.7 to about 14 milligrams of said reaction product per square inch of casing wall.

7. A casing as claimed in any one of the preceding claims, which additionally comprises a citrate selected from the group consisting of potassium citrate and sodium citrate.

8. A method for manufacturing a tubular food casing in which the casing is treated, prior to drying, with an aqueous solution of a reducing sugar and an amino compound selected from the group consisting of an amino acid, an amino acid derivative, and a mixture of an amino acid and an amino acid derivative, the casing is dried by heating at elevated temperatures so that simultaneously with drying, the said solution components react in situ in the casing to form a reaction product which gives the dried casing a smoke color which is water soluble and readily transferable to a food product.

9. A method as claimed in claim 8 wherein the casing is selected from the group consisting of a cellulose casing, a fibrous cellulose casing, a collagen casing, an insolubilized polyvinyl alcohol casing, and a fibrous insolubilized polyvinyl alcohol casing.

10. A method as claimed in claim 8 or 9 wherein said aqueous treating solution comprises a molar ratio of a reducing sugar to an amino compound of from about, 10 to 1, to about, 1 to 10.

11. A method as claimed in claim 8, 9 or 10 wherein the treated casing is heated and dried at a temperature and during a period of time from about 80°C for about 24 hours to about 120°C for about 5 minutes.

12. A method as claimed in any one of claims 8 to 11, wherein the aqueous treating solution additionally comprises a citrate compound.

13. A method as claimed in claim 12 wherein said citrate compound is selected from the group consisting of potassium citrate and soldium citrate.

14. A method as claimed in claim 12 or 13, wherein the molar ratio of said citrate compound to said reducing sugar is from about, 1 to 20, to about 1 to 1.

15. A method as claimed in any one of claims 8 to 14, wherein said amino compound is selected from the group consisting of 4-aminobutyric acid, glycine, lysine monohydrochloride, alanine, arginine, and monosodium glutamate.

16. A method as claimed in any one of claims 8 to 15, wherein said reducing sugar is selected from the group consisting of xylose, arabinose and dextrose.

17. A method for manufacturing a tubular food casing in which the casing is treated with a reaction product of a reducing sugar and an amino compound selected from the group consisting of an amino acid, an amino acid derivative, and a mixture of an amino acid and an amino acid derivative, in an amount sufficient to give the casing a smoke color which is water soluble and readily transferable to a food product.

18. A method as claimed in claim 17 wherein the casing is selected from the group consisting of a cellulose casing, a fibrous cellulose casing, a collagen casing, an insolubilized polyvinyl alcohol casing, and a fibrous insolubilized polyvinyl alcohol casing.

19. A method as claimed in claim 17 or 18 wherein said reaction product is formed from an aqueous solution initially comprising a molar ratio of a reducing sugar to an amino compound of from about, 10 to 1, to about 1 to 10.

20. A method as claimed in claim 19, wherein said aqueous solution is heated to a temperature of from about 60°C to about 110°C for about 5 minutes to about 30 minutes to cause the formation of said reaction product.

21. A method as claimed in claim 19 or 20 wherein said aqueous solution additionally comprises a citrate compound.

22. A method as claimed in claim 21 wherein said citrate compound is selected from the group consisting of potassium citrate and sodium citrate and wherein the molar ratio of said citrate compound to said reducing sugar is from about, 0 to 1, to about, 1 to 1.

23. A method as claimed in any one of claims 17 to 22, wherein said reaction product is in a treating mixture comprising from about 25 to about 50

weight percent water.

24. A method as claimed in any one of claims 17 to 23 wherein from about 2.7 to about 14 milligrams of reaction product per square inch of casing wall are added to the casing.

25. A method as claimed in any one of claims 17 to 24, wherein said amino compound is selected from the group consisting of 4-aminobutyric acid, glycine, lysine monohydro- chloride, alaine, arginine, and monosodium glutamate.

26. A method as claimed in any one of claims 17 to 25, wherein said reducing sugar is selected from the group consisting of xylose, arabinose and dextrose.

27. A casing suitable for imparting smoke color to food products when encased therein substantially as hereinbefore described in any one of the foregoing Examples.

28. A method for manufacturing a tubular food casing substantially as hereinbefore described in any one of the foregoing Examples.

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